

FORM PTO-1390 (Modified)
(REV 11-98)

U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE

ATTORNEY'S DOCKET NUMBER

**TRANSMITTAL LETTER TO THE UNITED STATES
DESIGNATED/ELECTED OFFICE (DO/EO/US)
CONCERNING A FILING UNDER 35 U.S.C. 371**

2308/250

U.S. APPLICATION NO. (IF KNOWN, SEE 37 C.

09/936457

INTERNATIONAL APPLICATION NO.

PCT/GB00/00917

INTERNATIONAL FILING DATE

13 March 2000 (13.03.00)

PRIORITY DATE CLAIMED

17 March 1999 (17.03.99)

TITLE OF INVENTION

METHOD AND APPARATUS FOR MANUFACTURING INNERSPRING ASSEMBLIES

APPLICANT(S) FOR DO/EO/US

WHITWORTH, Ian James

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
1. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. ☒ This is an express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(1).
4. ☒ A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.
5. ☒ A copy of the International Application as filed (35 U.S.C. 371 (c) (2))
 - a. ☐ is transmitted herewith (required only if not transmitted by the International Bureau).
 - b. ☒ has been transmitted by the International Bureau.
 - c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US).
6. ☐ A translation of the International Application into English (35 U.S.C. 371(c)(2)).
7. ☐ A copy of the International Search Report (PCT/ISA/210).
8. ☒ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371 (c)(3))
 - a. ☐ are transmitted herewith (required only if not transmitted by the International Bureau).
 - b. ☐ have been transmitted by the International Bureau.
 - c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
 - d. ☒ have not been made and will not be made.
9. ☐ A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
10. ☐ An oath or declaration of the inventor(s) (35 U.S.C. 371 (c)(4)).
11. ☒ A copy of the International Preliminary Examination Report (PCT/IPEA/409).
12. ☐ A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371 (c)(5)).

Items 13 to 20 below concern document(s) or information included:

13. ☐ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
14. ☐ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
15. ☒ A **FIRST** preliminary amendment.
16. ☐ A **SECOND** or **SUBSEQUENT** preliminary amendment.
17. ☐ A substitute specification.
18. ☐ A change of power of attorney and/or address letter.
19. ☒ Certificate of Mailing by Express Mail
20. ☐ Other items or information:

U.S. APPLICATION NO. (IF KNOWN, SEE 37 CFR 09/936457)	INTERNATIONAL APPLICATION NO. PCT/GB00/00917	ATTORNEY'S DOCKET NUMBER 2308/250
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21. The following fees are submitted:

BASIC NATIONAL FEE (37 CFR 1.492 (a) (1) - (5)) :

- ☐ Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO and International Search Report not prepared by the EPO or JPO **\$1,000.00**
- ☒ International preliminary examination fee (37 CFR 1.482) not paid to USPTO but International Search Report prepared by the EPO or JPO **\$860.00**
- ☐ International preliminary examination fee (37 CFR 1.482) not paid to USPTO but international search fee (37 CFR 1.445(a)(2)) paid to USPTO **\$710.00**
- ☐ International preliminary examination fee paid to USPTO (37 CFR 1.482) but all claims did not satisfy provisions of PCT Article 33(1)-(4) **\$690.00**
- ☐ International preliminary examination fee paid to USPTO (37 CFR 1.482) and all claims satisfied provisions of PCT Article 33(1)-(4) **\$100.00**

CALCULATIONS PTO USE ONLY

ENTER APPROPRIATE BASIC FEE AMOUNT = **\$860.00**

Surcharge of **\$130.00** for furnishing the oath or declaration later than ☐ 20 ☒ 30 months from the earliest claimed priority date (37 CFR 1.492 (e)). **\$130.00**

CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE	
Total claims	25 - 20 =	5	x \$18.00	\$90.00
Independent claims	3 - 3 =	0	x \$80.00	\$0.00
Multiple Dependent Claims (check if applicable).			<input type="checkbox"/>	\$0.00

TOTAL OF ABOVE CALCULATIONS = \$1,080.00

Reduction of 1/2 for filing by small entity, if applicable. Verified Small Entity Statement must also be filed (Note 37 CFR 1.9, 1.27, 1.28) (check if applicable). ☐ **\$0.00**

SUBTOTAL = \$1,080.00

Processing fee of **\$130.00** for furnishing the English translation later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492 (f)). **\$0.00**

TOTAL NATIONAL FEE = \$1,080.00

Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31) (check if applicable). ☐ **\$0.00**

TOTAL FEES ENCLOSED = \$1,080.00

Amount to be: refunded	\$
charged	\$

- ☒ A check in the amount of **\$1,080.00** to cover the above fees is enclosed.
- ☐ Please charge my Deposit Account No. _____ in the amount of _____ to cover the above fees.
A duplicate copy of this sheet is enclosed.
- ☒ The Commissioner is hereby authorized to charge any fees which may be required, or credit any overpayment to Deposit Account No. **14-1138** A duplicate copy of this sheet is enclosed.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO:

Michael L. Goldman
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Rochester, New York 14603

SIGNATURE

Joseph M. Noto

NAME

32,163

REGISTRATION NUMBER

DATE

September 13, 2001

EXPRESS MAIL CERTIFICATE

DOCKET NO.: 2308/250

APPLICANT(S): WHITWORTH, Ian James

TITLE: METHOD AND APPARATUS FOR MANUFACTURING INNERSPRING
ASSEMBLIESCertificate is attached to the Preliminary Amendment (4
pages) with Appendix A (2 pages) of the above-named application.

"EXPRESS MAIL" NUMBER: EL710757111US

DATE OF DEPOSIT: September 13, 2001

I hereby certify that this paper or fee is being
deposited with the United States Postal Service "Express Mail Post
Office to Addressee" service under 37 CFR 1.10 on the date
indicated above and is addressed to the Commissioner of Patents and
Trademarks, Box PCT, Washington, D.C. 20231.

Ruth R. Smith
(Typed or printed name of person
mailing paper or fee)

Ruth R. Smith
(Signature of person mailing paper or
fee)

Docket No: 2308/250

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: WHITWORTH, Ian James)
U. S. Serial No: To be assigned)
Filed: Herewith)
PCT International)
Application No: PCT/GB00/00917)
Filed: 13 March 2000)
Claiming Priority from)
Great Britain Application No: 9905964.4)
Priority Date: 17 March 1999)
For : METHOD AND APPARATUS FOR)
MANUFACTURING INNERSPRING)
ASSEMBLIES)

PRELIMINARY AMENDMENT

Commissioner of Patents
and Trademarks
Washington, D.C. 20231
BOX: PCT

Dear Sir:

Please amend the above-identified patent application as follows:

In the Claims:

3. (Amended) A method as claimed in Claim 1, wherein the first string of pocketed coil springs is positioned by being fed longitudinally and then displaced transversely into juxtaposition with the adhesive applicators.
4. (Amended) A method as claimed in Claim 1, wherein following application of the adhesive to the first string, the first string is tipped into an upright position such that

5. (Amended) A method as claimed in Claim 1, wherein the second string has immediately beforehand been processed in the same manner as the first string.

7. (Amended) A method as claimed in Claim 1, wherein the adhesive which is applied to the first string is a hot melt adhesive.

8. (Amended) A method as claimed in Claim 1, wherein adhesive is dispensed from the adhesive applicators with those applicators in fixed, stationary positions relative to the first string.

9. (Amended) A method as claimed in Claim 1, wherein adhesive is dispensed from the adhesive applicators whilst movement of the applicators relative to the first string is taking place.

14. (Amended) Apparatus as claimed in Claim 12, wherein each applicator has a downwardly directed outlet for adhesive.

15. (Amended) Apparatus as claimed in Claim 12, wherein each applicator is provided with more than one outlet for adhesive.

16. (Amended) Apparatus as claimed in Claim 12, comprising a turning mechanism by which the first string is tipped into an upright position such that the surface of the first string to which adhesive has been applied is brought into contact with the surface of the second string.

19. (Amended) Apparatus as claimed in Claim 12, further comprising mechanical means for bringing about movement of the first string.

21. (Amended) Apparatus as claimed in Claim 12, further comprising sensors to monitor and control the movements of the first string.

22. (Amended) An innerspring assembly manufactured by the method of Claim 1.
23. (Amended) An innerspring assembly as claimed in claim 22, in combination with a mattress.

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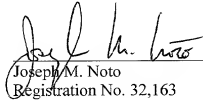
REMARKS

Entry of the foregoing prior to the initial office action on the merits is respectfully requested. Pursuant to 37 C.F.R. § 1.121, attached as Appendix A is a version with markings to show changes made to the claims.

Early allowance of the pending claims is hereby earnestly solicited.

Respectfully submitted,

Date: 9/13/01



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0936457-037202

APPENDIX A

Version With Markings to Show Changes Made

In reference to the amendments made herein to claims 3-9, 14-16, 19, and 21-22, additions appear as underlined text, while deletions appear as bracketed text, as indicated below:

In The Claims:

3. (Amended) A method as claimed in Claim 1 [or Claim 2], wherein the first string of pocketed coil springs is positioned by being fed longitudinally and then displaced transversely into juxtaposition with the adhesive applicators.
4. (Amended) A method as claimed in Claim 1 [any preceding claim], wherein following application of the adhesive to the first string, the first string is tipped into an upright position such that the surface of the first string to which adhesive has been applied is brought into contact with the surface of the second string.
5. (Amended) A method as claimed in Claim 1 [any preceding claim], wherein the second string has immediately beforehand been processed in the same manner as the first string.
6. (Amended) A method as claimed in Claim 1 [any preceding claim], wherein the movements of the first string are brought about by suitable mechanical means, using electrical, hydraulic or pneumatic power.
7. (Amended) A method as claimed in Claim 1 [any preceding claim], wherein the adhesive which is applied to the first string is a hot melt adhesive.
8. (Amended) A method as claimed in Claim 1 [any preceding claim], wherein adhesive is dispensed from the adhesive applicators with those applicators in fixed, stationary positions relative to the first string.
9. (Amended) A method as claimed in Claim 1 [any preceding claim], wherein adhesive is dispensed from the adhesive applicators whilst movement of the applicators relative to the first string is taking place.

14. (Amended) Apparatus as claimed in Claim 12 [or Claim 13], wherein each applicator has a downwardly directed outlet for adhesive.

15. (Amended) Apparatus as claimed in Claim 12 [any one of Claims 12 to 14], wherein each applicator is provided with more than one outlet for adhesive.

16. (Amended) Apparatus as claimed in Claim 12 [any one of claims 12 to 15], comprising a turning mechanism by which the first string is tipped into an upright position such that the surface of the first string to which adhesive has been applied is brought into contact with the surface of the second string.

19. (Amended) Apparatus as claimed in Claim 12 [any one of Claims 12 to 18], further comprising mechanical means for bringing about movement of the first string.

21. (Amended) Apparatus as claimed in Claim 12 [any one of Claims 12 to 20], further comprising sensors to monitor and control the movements of the first string.

22. (Amended) An innerspring assembly manufactured by the method of Claim 1 [any one of Claims 1 to 11].

23. (Amended) An innerspring assembly as claimed in claim 22, [which is for use] in combination with a mattress.

09/936 457

Title - Method and Apparatus for Manufacturing Innerspring Assemblies

This invention relates to a method and apparatus for manufacturing innerspring assemblies, in particular innerspring assemblies for mattresses or the like, said innerspring assemblies comprising chains of pocketed coil springs arranged side by side and adhered together

5 laterally by adhesive.

It is well known to assemble innerspring assemblies for mattresses and the like from pocketed coil springs. Typically, chains of pocketed springs are manufactured by feeding the springs direct from a spring coiling machine into the space between two plies of a weldable fabric, the two plies then being sealed together to form a pocket which encapsulates

10 the spring. The fabric is then indexed forward, the next spring encapsulated, and so on. In this way, lengthy chains of pocketed springs are built up. Such chains of pocketed springs are referred to herein as "strings" of springs.

An innerspring assembly of appropriate dimensions for a mattress can then be built up by placing appropriate lengths of pocketed spring chain side by side and adhering them together.

Automated methods for forming innerspring assemblies in this way, and apparatus for carrying out such methods, are known. European Patent No 0154076, for example, discloses a method in which an adhesive applicator is passed over a string of pocketed springs, the applicator being actuated briefly as it passes over each spring so as to apply a line of adhesive

15 to the spring, parallel to the lines defining the transverse sides of the pockets, and then

20 contacting the string of springs against another similar string of springs.

European Patent No 0421495 discloses another method in which a string of pocketed springs is passed longitudinally past a fixed adhesive applicator such that adhesive is applied to one side of the string, which is then pressed into contact with a corresponding side of a second string of springs.

In both of the above methods the amount of adhesive applied to the various springs in each string is substantially the same. This can be a disadvantage in that it results in the innerspring assembly having a uniform degree of firmness along its whole length. Sometimes it is desirable for the firmness of the innerspring assembly to vary along its length. For instance, it is known to manufacture a mattress with three zones of firmness, the central region, which carries the greatest part of the weight of a person lying on the mattress, being relatively stiff, whilst the head and foot parts of the mattress are less stiff for greater comfort. A more sophisticated arrangement is a five zone mattress in which the central part is again the stiffest, but the extreme ends are also somewhat stiffer than the intermediate regions. Such arrangements cannot easily be produced using known innerspring assembly apparatus. Another disadvantage of the known systems is that the need to move the string of springs past a fixed adhesive applicator, or to move an applicator over a string of springs, may slow down the manufacturing process.

There have now been devised a method and apparatus for the manufacture of innerspring assemblies, which overcome or substantially mitigate the above-mentioned or other disadvantages of the prior art.

According to a first aspect of the invention, there is provided a method for the manufacture of an innerspring assembly, which method comprises the steps of

- a) positioning a first string of pocketed coil springs in juxtaposition with a plurality of adhesive applicators disposed in mutually fixed relation on an axis parallel to a longitudinal axis of said first string,
- b) applying adhesive from said adhesive applicators to said first string of pocketed coil springs, and
- c) bringing said first string into adhesive contact with a second string of pocketed coil springs.

The method according to the invention is advantageous primarily in that, because a plurality of adhesive applicators are used, the amount and/or distribution of adhesive applied to each

individual pocket may be varied, thereby enabling control of the firmness of regions of the innerspring assembly, and hence of the finished mattress. Also, because the adhesive may be applied simultaneously from the adhesive applicators to all the pockets of the first string (rather than being applied to the pockets sequentially), an increase in operating speed and throughput may be achieved. Also, where the adhesive applicators are actuated simultaneously, the length of time between dispensing of the adhesive and contacting of the first and second may be minimised and is also the same for all parts of the strings, leading to improved and more consistent adhesion.

The invention also provides an innerspring assembly manufactured by the method of the first aspect of the invention.

According to another aspect of the invention, there is provided apparatus for use in the manufacture of an innerspring assembly, which apparatus comprises a plurality of adhesive applicators, means for positioning a first string of pocketed coil springs in juxtaposition with said plurality of adhesive applicators, and means for bringing said first string into adhesive contact with a second string of pocketed coil springs, wherein said plurality of adhesive applicators are disposed in mutually fixed relation on an axis parallel to a longitudinal axis of said first string.

For most applications, adhesive is preferably dispensed from the plurality of adhesive applicators simultaneously or substantially simultaneously.

Preferably, the first string of pocketed coil springs is fed longitudinally to the apparatus of the invention and then displaced transversely into juxtaposition with the adhesive applicators. Most preferably, the adhesive applicators are arranged in a line and are disposed above the path of transverse movement of the first string. Each applicator will generally have a downwardly directed outlet for adhesive (which will normally be in the form of a liquid), normally in the form of a nozzle. For some applications, each applicator may be provided with more than one outlet, eg a number of nozzles arranged in a row transverse or parallel

to the longitudinal axis of the first string, or a single nozzle with more than one orifice arranged to dispense adhesive in different directions.

The first string may be manufactured by conventional techniques, eg by inserting the springs in compressed condition between the plies of a folded sheet of ultrasonically weldable fabric and forming closed compartments for each spring by making a series of welds.

Following application of the adhesive to the first string, the first string is preferably displaced onto a turning mechanism by which the first string is tipped into an upright position such that the surface of the first string to which adhesive has been applied is brought into contact with the surface of the second string. The second string will most commonly be a string which has immediately beforehand been processed in the same manner as the first string. The turning mechanism most preferably comprises a plate disposed parallel to the adhesive applicators. The plate preferably has a width corresponding approximately to the width of the first string and pivots about its major edge which is remote from the adhesive applicators. When the first string is displaced onto the plate, the plate can thus be pivoted to tip the first string away from the adhesive applicators and into contact with the second string. The turning mechanism is most preferably provided with means for retaining the string of springs in position during the turning operation. Such means conveniently comprises one or more electromagnets which are activated when the string of springs has been displaced onto the turning plate and are switched off once the first string is pressed into contact with the second string.

The various movements of the first string, ie into alignment with the adhesive applicators, transversely beneath the adhesive applicators, and onto the turning plate, are most conveniently brought about by suitable mechanical means, eg using electric, hydraulic or pneumatic power. Suitable sensors are preferably provided to monitor and control the various movements, in generally conventional fashion.

The adhesive which is applied to the first string may be one of those adhesives which are

conventionally used in the manufacture of innerspring assemblies. Hot melt adhesives are particularly suitable. In general, any conventional adhesive having the desired properties (eg strong adhesion, good flow properties, and lack of odour) may be used.

For many applications adhesive will be dispensed from the adhesive applicators with those applicators in fixed, stationary positions relative to the string of springs. In other cases, however, adhesive may be dispensed whilst controlled movement of the applicators relative to the string of springs is taking place. This may be necessary or desirable, for example to achieve a particular (eg elongated) distribution of adhesive on the surface of some or all of the pockets. Obviously, such an effect may be achieved either by moving the applicators relative to a stationary string of springs, or (as may be more convenient) displacing the string of springs relative to fixed applicators.

It may also be desirable for the separation of the adhesive applicators from the string of springs to be adjustable, eg to vary the size of the area to which adhesive is applied. Such an arrangement also allows spring pockets of different diameters to be accommodated.

As explained above, the present invention enables the manufacture of innerspring assemblies which are "zoned", ie which have portions of differing firmness. Thus, according to a further aspect of the invention, there is provided an innerspring assembly which comprises strings of pocketed coil springs, said strings being joined by adhesive applied to abutting surfaces of the pockets of adjacent strings, wherein the quantity and/or distribution of adhesive applied to the pockets of adjoining strings is non-uniform. Such an innerspring assembly may comprise at least one portion in which adjacent strings are connected by relatively high quantities of adhesive applied to the pockets of those strings, and at least one portion in which adjacent strings are connected by relatively low quantities of adhesive applied to the pockets of those strings.

It will be understood that, although reference is made above principally to innerspring assemblies for use in mattresses, the same methods and apparatus may be used in the

manufacture of innerspring assemblies for cushions and the like.

The invention will now be described in greater detail, by way of illustration only, with reference to the accompanying drawings, in which

Figure 1 is a schematic plan view of apparatus in accordance with the invention;

Figure 2 is a view on the line II-II in Figure 1;

Figure 3 is a fragmentary perspective schematic view illustrating stages in the carrying out of the invention;

Figure 4 is a schematic view of a string of pocketed springs for use in the manufacture of a "3-zone" mattress;

Figure 5 is a view similar to Figure 4, but of a string of pocketed springs for use in the manufacture of a mattress having a "5-zone" construction;

Figure 6 is a side view of pocketed springs showing a mode of application of adhesive suitable for assembly of a mattress having a nested spring configuration; and

Figure 7 is a plan view of a nested innerspring assembly.

Referring first to Figures 1 and 2, apparatus for the manufacture of an innerspring assembly is generally designated 1. The apparatus 1 is fed with a continuous chain 2 of pocketed coil springs which may be manufactured by conventional techniques.

A string 6 of pocketed springs is cut to a suitable length by conventional cutting means (not shown) from the leading portion of the chain 2. The string 6 is transported longitudinally onto a bed 4 by a suitable conveyor means (also not shown). In the example illustrated, the

string 6 has a length of twenty pocketed springs, this length corresponding to the length of the finished innerspring assembly.

Once the leading string 6 has been deposited on the bed 4, the conveyor means halts temporarily. The string 6 is then driven laterally across the bed 4 by a transport plate 8 which in the illustrated embodiment is actuated by a pair of pneumatic rams 10. For increased precision it may be preferable for the transport plate 8 to be driven by a servo motor. A row of twenty adhesive guns 12 are disposed above the path of the string 6 and are actuated as the string 6 passes beneath them, so as to deposit a quantity of hot melt adhesive on the upwardly facing surface of each pocket in the string 6. This may be achieved by brief

actuation of the adhesive guns 12 whilst the string 6 is in motion beneath the guns 12. Alternatively, movement of the string 6 beneath the guns 12 may be halted temporarily whilst the guns 12 are actuated. It will be appreciated that by appropriate control of the movement of the string 6 and actuation of the guns 12, a variety of different patterns of adhesive may be applied to the surface of the pockets making up the string 6. For instance, the adhesive may be applied as a single, generally circular spot 13 (as shown in Figure 3), or as a series of spots disposed longitudinally along the pocket (or otherwise, as described below), or a continuous line of adhesive may be applied along the pocket. Similarly, it is possible for all the guns 12 to be actuated so that adhesive is applied to all the pockets, or for only some of the guns 12 to be actuated.

After application of the adhesive, the string 6 is transported further, in the same direction, by the transport plate 8, onto a turning table 14. The turning table 14 rotates through 90°, thereby tipping the string 6 into an upright position and pressing the surface of the string 6 to which adhesive has been applied into contact with the corresponding surface of a previously processed string 6a which rests on a main bed 16. Electromagnets (not shown) fitted beneath the turning table 14 hold the string 6 in place during the tipping operation. While the string 6 is being turned, the pneumatic rams 10 withdraw the transport plate 8 to its starting position (as shown in Figures 1 and 2) and the next string is conveyed onto the bed 4. The next string is then processed in the same manner as the preceding string 6. In this

manner, the completed innerspring construction is built up from successive strings 6, 6a, 6b etc.

The degree of adhesion between adjacent pockets in successive strings in the assembled innerspring assembly determines the degree of firmness of that part of the innerspring assembly, and hence of that part of a mattress in which the innerspring assembly is used. It is thus possible to control the firmness of the mattress by appropriate application of adhesive to the respective pockets. Figure 4 shows a pattern of adhesive application appropriate for a so-called "3-zone" mattress. In such a construction, the head and foot parts of the mattress are relatively soft, while the central region of the mattress is relatively firm. To achieve such a result, adhesive is applied to a larger area 21 of the pockets in the central part b of each string, as compared with the area 22 of the adhesive applied to the pockets at the two end portions a,c of the string.

Figure 5 shows a somewhat more complex pattern of adhesive application, suitable for the formation of a "5-zone" mattress. In such a mattress, the central region m is again the firmest (adhesive being applied to the largest area 31), but in this case the extreme head and foot parts k,o are of intermediate firmness (adhesive area 32), being separated from the central region k by relatively soft regions L,n (smallest adhesive regions 33).

The patterns of adhesive application shown in Figures 4 and 5 are appropriate for innerspring assemblies in which the spring pockets are arranged with their centres in a square array, ie in which the pockets are arranged in regular longitudinal and transverse rows. Another arrangement which is sometimes used is a so-called nested arrangement, in which the spring pockets are arranged in an hexagonal array. Such an array is shown in Figure 7. Because, in the formation of such an array, it is not the central part of each spring pocket which is pressed against the pockets of the previous string, but rather surfaces of the pocket which are offset from the centre line, the adhesive application pattern shown in Figure 6 is more appropriate. This pattern consists of two circular areas of adhesive 41,42 applied to each pocket, the two areas 41,42 being spaced apart along, and offset from, the longitudinal axis

of each pocket. A pattern of this form may be created by applying adhesive first to the areas 41, with the adhesive guns 12 offset from the centre lines of the pockets, and then moving the adhesive guns 12 to a second position, offset in the other direction, and applying adhesive then to the second areas 42. The separation of the two areas 41,42 along the centre lines of the pockets is brought about by the movement of the string towards the turning table between the two applications of adhesive.

Clearly, in order to enable the two areas of adhesive to be applied on opposite sides of the centre line of each pocket it is necessary for there to be means for displacing the adhesive guns 12 relative to the string. There may therefore be provided means for moving the guns 12 as a unit, or for displacing the string a short distance along its longitudinal axis relative to fixed guns. In a further alternative, a pattern such as that shown in Figure 6 could be produced using two rows of adhesive guns, both arranged on axes parallel to the longitudinal axis of the string but offset from one another such that the guns of one row deposit adhesive to one side of the pocket centre lines (say the first areas 41) and the other row of guns deposit adhesive to the other side (ie to the second areas 42).

It will also be appreciated that patterns of adhesive may also be produced by the method of the invention in which adhesive is applied to two (or more) areas on the centre line of some or each of the pockets. Such areas of adhesive may be discrete, or they may overlap or merge to form single, larger areas.

Claims

1. A method for the manufacture of an innerspring assembly, which method comprises the steps of
 - a) positioning a first string of pocketed coil springs in juxtaposition with a plurality of adhesive applicators disposed in mutually fixed relation on an axis parallel to a longitudinal axis of said first string,
 - b) applying adhesive from said adhesive applicators to said first string of pocketed coil springs, and
 - c) bringing said first string into adhesive contact with a second string of pocketed coil springs.
2. A method as claimed in Claim 1, wherein adhesive is applied from said plurality of adhesive applicators simultaneously or substantially simultaneously.
3. A method as claimed in Claim 1 or Claim 2, wherein the first string of pocketed coil springs is positioned by being fed longitudinally and then displaced transversely into juxtaposition with the adhesive applicators.
4. A method as claimed in any preceding claim, wherein following application of the adhesive to the first string, the first string is tipped into an upright position such that the surface of the first string to which adhesive has been applied is brought into contact with the surface of the second string.
5. A method as claimed in any preceding claim, wherein the second string has immediately beforehand been processed in the same manner as the first string.
6. A method as claimed in any preceding claim, wherein the movements of the first string are brought about by suitable mechanical means, using electric, hydraulic or pneumatic power.

7. A method as claimed in any preceding claim, wherein the adhesive which is applied to the first string is a hot melt adhesive.
8. A method as claimed in any preceding claim, wherein adhesive is dispensed from the adhesive applicators with those applicators in fixed, stationary positions relative to the first string.
9. A method as claimed in any one of Claims 1 to 7, wherein adhesive is dispensed from the adhesive applicators whilst movement of the applicators relative to the first string is taking place.
10. A method as claimed in Claim 9, wherein the first string is stationary and the applicators are moved.
11. A method as claimed in Claim 9, wherein the applicators are fixed and the first string is displaced.
12. Apparatus for use in the manufacture of an innerspring assembly, which apparatus comprises a plurality of adhesive applicators, means for positioning a first string of pocketed coil springs in juxtaposition with said plurality of adhesive applicators, and means for bringing said first string into contact with a second string of pocketed coil springs, wherein said plurality of adhesive applicators are disposed in mutually fixed relation on an axis parallel to a longitudinal axis of said first string.
13. Apparatus as claimed in Claim 12, wherein the adhesive applicators are arranged in a line.
14. Apparatus as claimed in Claim 12 or Claim 13, wherein each applicator has a downwardly directed outlet for adhesive.

15. Apparatus as claimed in any one of Claims 12 to 14, wherein each applicator is provided with more than one outlet for adhesive.
16. Apparatus as claimed in any one of Claims 12 to 15, comprising a turning mechanism by which the first string is tipped into an upright position such that the surface of the first string to which adhesive has been applied is brought into contact with the surface of the second string.
17. Apparatus as claimed in Claim 16, wherein the turning mechanism comprises a plate disposed parallel to the adhesive applicators.
18. Apparatus as claimed in Claim 17, wherein the plate has a width corresponding approximately to the width of the first string and pivots about its major edge which is remote from the adhesive applicators.
19. Apparatus as claimed in any one of Claims 12 to 18, further comprising mechanical means for bringing about movement of the first string.
20. Apparatus as claimed in Claim 19, wherein the mechanical means operate under electric, hydraulic or pneumatic power.
21. Apparatus as claimed in any one of Claims 12 to 20, further comprising sensors to monitor and control the movements of the first string.
22. An innerspring assembly manufactured by the method of any one of Claims 1 to 11.
23. An innerspring assembly as claimed in Claim 22, which is for use in a mattress.
24. An innerspring assembly which comprises strings of pocketed coil springs, said

strings being joined by adhesive applied to abutting surfaces of the pockets of adjacent strings, wherein the quantity and/or distribution of adhesive applied to the pockets of adjoining strings is non-uniform.

25. An innerspring assembly as claimed in Claim 24, which comprises at least one portion in which adjacent strings are connected by relatively high quantities of adhesive applied to the pockets of those strings and at least one portion in which adjacent strings are connected by relatively low quantities of adhesive applied to the pockets of those strings.

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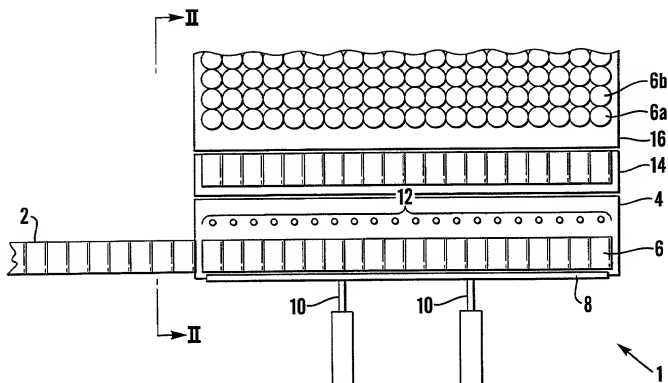


Fig. 1

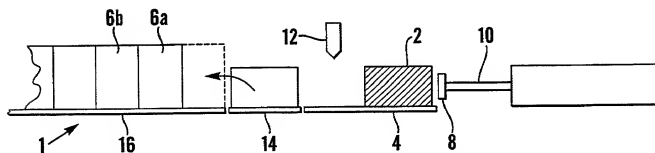
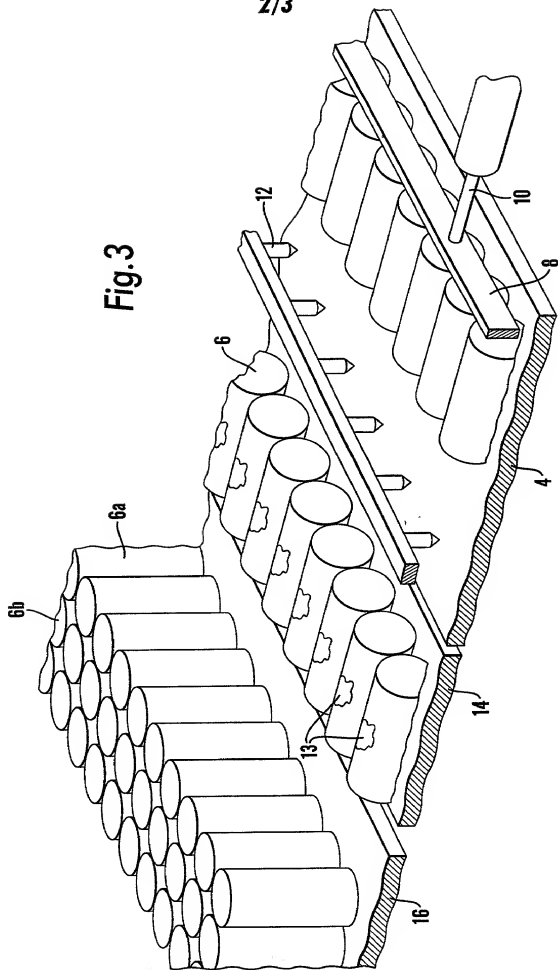


Fig. 2

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Fig.3



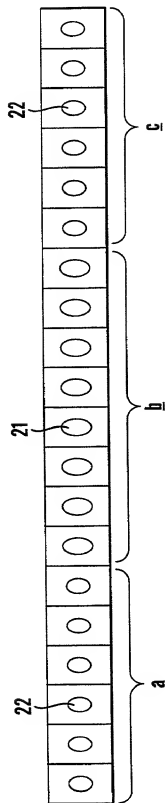


Fig. 4

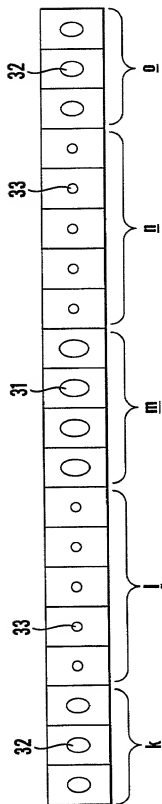


Fig. 5

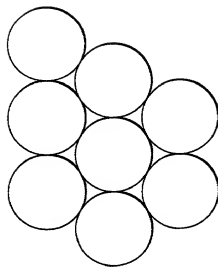


Fig. 7

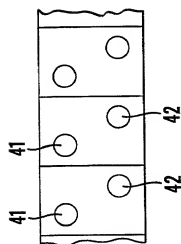


Fig. 6

COMBINED DECLARATION FOR PATENT
APPLICATION AND POWER OF ATTORNEY
(Includes Reference to PCT International Applications)

ATTORNEY'S DOCKET NUMBER
2308/250

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

METHOD AND APPARATUS FOR MANUFACTURING INNERSPRING ASSEMBLIES

the specification of which (check only one item below):

- ☐ is attached hereto.
- ☐ was filed as U.S. Patent Application Serial No. _____ on _____ and was amended on _____ (if applicable).
- ☒ was filed as PCT International Application Number **PCT/GB00/00917** on **March 13, 2000** and assigned U.S. Patent Application Serial No. **09/936,457**.

I hereby state that I have reviewed and understand the contents of the above-identified specifications, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the patentability of this application in accordance with Title 37, Code of Federal Regulations, § 1.56(a).

I hereby claim priority benefits under Title 35, United States Code, § 119 of any application(s) for patent or inventor's certificate or of any PCT international application(s) designating at least one country other than the United States listed below and have also identified below any application(s) for patent or inventor's certificate or any PCT international application(s) designating at least one country other than the United States of America filed by me on the same subject matter having a filing date before that of the application(s) of which priority is claimed:

PRIOR APPLICATION(S) AND ANY PRIORITY CLAIMS UNDER 35 U.S.C. 119:

COUNTRY (IF PCT, indicate "PCT")	APPLICATION NUMBER	DATE OF FILING (day, month, year)	PRIORITY CLAIMED UNDER 35 USC 119
Great Britain	GB 9905964.4	17 March 1999	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO
			<input type="checkbox"/> YES <input type="checkbox"/> NO
			<input type="checkbox"/> YES <input type="checkbox"/> NO
			<input type="checkbox"/> YES <input type="checkbox"/> NO
			<input type="checkbox"/> YES <input type="checkbox"/> NO
			<input type="checkbox"/> YES <input type="checkbox"/> NO
			<input type="checkbox"/> YES <input type="checkbox"/> NO
			<input type="checkbox"/> YES <input type="checkbox"/> NO

**COMBINED DECLARATION FOR PATENT
APPLICATION AND POWER OF ATTORNEY (Continued)**
(Includes Reference to PCT International Applications)

ATTORNEY'S DOCKET NUMBER
2308/250

I hereby claim the benefit under Title 35, United States Code, § 120 of any United States application(s) or PCT international application(s) designating the United States of America that is/are listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in that/those prior application(s) in the manner provided by the first paragraph of Title 35, United States Code, § 112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, § 1.56(a) which occurred between the filing date of the prior application(s) and the national or PCT International filing date of this application:

PRIOR U.S. APPLICATIONS OR PCT INTERNATIONAL APPLICATIONS DESIGNATING THE U.S. FOR BENEFIT UNDER 35 U.S.C. 120:

U.S. APPLICATIONS		STATUS (Check One)		
U.S. APPLICATION NUMBER	U.S. FILING DATE	PATENTED	PENDING	ABANDONED
PCT APPLICATIONS DESIGNATING THE U.S.				
PCT APPLICATION NO.	PCT FILING DATE	U.S. SERIAL NUMBERS ASSIGNED (if any)		
PCT/GB00/00917	17 March 2000	09/936,457		

POWER OF ATTORNEY: As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith. **Michael L. Goldman, Registration No. 30,727; Joseph M. Noto, Registration No. 32,163; Ann R. Pokalsky, Registration No. 34,697; Gunnar G. Leinberg, Registration No. 35,584; Edwin V. Merkel, Registration No. 40,087; Georgia Evans, Registration No. 44,597; Alice Y. Choi, Registration No. 45,758; Andrew K. Gonsalves, Registration No. 48,145; Noreen L. Connolly, Registration No. 48,987; John Campa, Registration No. 49,014**

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2	POST OFFICE ADDRESS	P.O. ADDRESS	CITY	STATE & ZIP CODE/COUNTRY
3	FULL NAME OF INVENTOR	FAMILY NAME	FIRST GIVEN NAME	SECOND GIVEN NAME
4	RESIDENCE & CITIZENSHIP	CITY	STATE/FOREIGN COUNTRY	COUNTRY OF CITIZENSHIP
5	POST OFFICE ADDRESS	P.O. ADDRESS	CITY	STATE & ZIP CODE/COUNTRY
6	FULL NAME OF INVENTOR	FAMILY NAME	FIRST GIVEN NAME	SECOND GIVEN NAME
7	RESIDENCE & CITIZENSHIP	CITY	STATE/FOREIGN COUNTRY	COUNTRY OF CITIZENSHIP
8	POST OFFICE ADDRESS	P.O. ADDRESS	CITY	STATE & ZIP CODE/COUNTRY

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

SIGNATURE OF INVENTOR 201	SIGNATURE OF INVENTOR 202	SIGNATURE OF INVENTOR 203
DATE 9 NOVEMBER 2001	DATE	DATE